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EXAMINER	
MCCRACKEN, DANIEL	

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
04/30/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/521,453	MARUYAMA ET AL.	
	Examiner	Art Unit	
	DANIEL C. MCCRACKEN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 August 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-23,25 and 26* is/are pending in the application.

4a) Of the above claim(s) *25,34 and 36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-23,26-33 and 35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *14-23 and 25-36* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Response to Arguments

The non-final office action dated 11/18/2008 is vacated and rescinded. The time period for response is set from the mailing dated of this office action.

Election/Restriction

Applicant's election with traverse of the method claims in the reply filed on 8/28/2008 is acknowledged. The traversal is on the ground(s) that "that restriction of these claims is not proper under PCT practice as they relate to an apparatus specifically designed for carrying out the currently claimed methods in the present Application." (Remarks of 8/28/2008 at 8). This is not found persuasive because the apparatus is not specifically designed for carrying out the claimed method. The apparatus can be used for other methods, for example coating. Furthermore, the apparatus claims were presented after a first action on the merits. No apparatus claims were previously presented. "The claims originally presented and acted upon by the Office on their merits determine the invention elected by an applicant in the application, and in any request for continued examination (RCE) which has been filed for the application. Subsequently

presented claims to an invention other than that acted upon should be treated as provided in MPEP § 821.03." MPEP 818.02(a).

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections 35 USC §§ 102-103,112

All rejections are withdrawn in light of Applicants amendment. New rejections appear forthwith.

Drawings

Figure 5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Review of the Specification shows that it does not support the amendments to all claims. Specifically, it is unclear where "separating the fiber from the catalyst, creation of a reacted reaction gas," and recycling the cooled and second-cooled reacted gas as claimed in the dependent claims. Furthermore, it is not clear whether Applicants are drawing support from their marked up copy of the specification or their originally filed specification. To the extent the Examiner has overlooked the portion relied upon, Applicants are respectfully requested to indicate this in their response.

The Specification lacks any of the details that would convey to one ordinary skill in the art that Applicants had possession of an "*axial* chiral fine carbon fiber." Such details would presumably include micrographs. For example, see Lau, et al., *The revolutionary creation of new advanced materials - carbon nanotube composities*, Composites: Part B 2002; 33: 263-277. (note "Fig 9 on p. 268, showing one of the chiralities captured by a microscope). Applicants have not provided any detail to indicate they had possession of any nanotube, let alone an "axial chiral fine carbon fiber."

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not

described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The analysis for determining whether a claim is supported by the disclosure is cast in terms of whether "undue experimentation" is necessary to practice the invention. *See* MPEP 2164.01. In examining the claims in light of the supporting disclosure, the Federal Circuit has provided a non-exclusive list of factors to consider in determining whether a disclosure is enabling. *See generally In re Wands,* 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). These factors include:

a. The breadth of the claims;
b. The nature of the invention;
c. The state of the prior art;
d. The level of one of ordinary skill;
e. The level of predictability in the art;
f. The amount of direction provided by the inventor;
g. The existence of working examples; and
h. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

Id. "Whether undue experimentation is needed is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual considerations." *Id.* Examiner has considered all factors in light of all claims rejected makes the following findings of fact:

a. The breadth of the claims

Claims 33 and 35 are the independent claims. They claim a process wherein carbon nanotubes (or in the Japanese parlance "fine carbon fibers") are produced via thermal decomposition of hydrocarbons. The claims broadly recite various "parts" that perform various functions.

Claims 27-32 further narrow Claims 33 and 35 to claim various diameters as well as a one specific chirality or type of nanotube, namely one with an "axial chiral" structure. Claims 27 and 28 recite very narrow nanotubes.

b. The nature of the invention

The invention is drawn to a process for making "fine carbon fibers" from oxygen containing hydrocarbons.

c. The state of the prior art and the level of one of ordinary skill

The level of skill in the art is typically high (*e.g.* PhD level chemists). The prior art is fairly well developed, but wide-spread owing to the applicability of nanotubes in a variety of fields.

d. The level of predictability in the art

This is an unpredictable art. For example, see Kim, et al., *Synthesis of Ultralong and High Percentage of Semiconducing Single-walled Carbon Nanotubes*, Nano Letters 2002; 2(7): 703-708. Note the passage at page 706, col. 2 which is reproduced below:

> It is therefore concluded that our CVD growth conditions in fact produce SWNTs with no preference in chirality (Table 1). ***This result is not surprising considering the high growth temperature that can smear out the differences in thermodynamic energetics and kinetics for the growth of various chirality nanotubes.*** The initial nanotube nucleation process appears to be a determining step for tube chirality, after which the same chirality tends to be retained during nanotube lengthening in the base growth1,2 mode. ***An important task then is to elucidate how various factors during nucleation determine the nanotube chirality by experiments and theory. These factors include growth temperature and structures of the nanoparticle seeds (diameter, shape, etc.).*** The interfacial

> structure between the nanoparticle and its supporting substrate could also play an important role. ***Understanding and controlling these factors will be indispensable to controlling nanotube chirality.***

(Kim at 706) (emphasis added). Clearly, controlling chirality is not without its difficulties. Likewise, making the small diameters claimed is not without its challenges. The Examiner's understanding of the prior art indicates that this is only possible with an arc-discharge process. For example, *see* Qin, et al., *The smallest carbon nanotube*, Nature 2000; 408: 50-51. Note especially col. 3 ("It remains a challenge to produce single-walled carbon nanotubes of 4A diameter experimentally.").

e. The amount of direction provided by the inventor

Insofar as the Examiner could determine, scant guidance was provided. Noteworthy was the lack of discussion of the factors discussed by Kim, et al. insofar as they relate to chirality.

f. The existence of working examples

Several working examples were presented, but these do not detail the sizes or chiralities claimed.

g. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

Given the unpredictable nature of the art (*see* Kim) and the lack of guidance presented, arguably infinite but at least undue experimentation is needed to practice the claimed invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to Claims 33 and 35, it is not clear what reaction Applicants are trying to describe. Presumably the reacted gas forms the "fine carbon fiber." Are Applicants claiming another reaction? This ambiguity precludes a targeted search, is it is not clear what is reacted, what is cooled, etc. With respect to Claims 27, 30 and 32 as well as Claims 28, 29 and 31, Applicants claim "fine carbon fibers" with a diameter between 0.1 nm and 1 nm (Claims 27 and 28). The dependent claims then broaden this range out (*i.e.* failure to limit) to 5 nm or less and 10 nm or less. How is this possible? Ranges within ranges, especially when one range is not within the other, are prima facie indefinite. With respect to Claims 29-32, "axial chiral" is indefinite. Applicants should submit the IUPAC Compendium. The Examiners initial comments in the Final Office action are correct in that all types of nanotubes are referred to as "chiralities" in the art. If Applicants are referring to one over the other (i.e. "chiral" over "zig-zag"), that is fine, but it says nothing of "axial" which modifies "chiral." What is this? All other claims import the defects of the claims they depend from.

Claim Rejections - 35 USC § 102

Claims 14-23, 26-33, and 35 rejected under 35 U.S.C. 102(e) as being anticipated by US 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon nanotubes* 756-776 (Academic Press 1996) (hereinafter "Dresselhaus at __") to show a state of fact.[1]

With respect to Claim 33, Resasco discloses a method for making carbon nanotubes wherein an oxygen containing organic compound (i.e. "an IUPAC group 16 periodic table element") is thermally decomposed with the aid of a transition metal catalyst. *See e.g.* (Resasco 6: 50-56) (thermal decomposition), (Resasco 6: 63 – 7:64) (catalyst – note transition metals are taught at least at 7: 1-12), *and* (Resasco 7: 65—8: 10) (teaching alcohols and ketones). Resasco recites any number of collecting and separating steps, and the apparatuses for accomplishing them. *See e.g.* (Resasco "Figs 2-5," 13: 35 *et seq.*) Other embodiments in Resasco may disclose collecting and separating, and Applicants are put on notice that the entire document is considered relevant. Note that Resasco teaches cooling. *See e.g.* (Resasco 9: 35-36). Finally, any number of recycle loops are taught. *See e.g.* (Resasco "Figs 2-5," 13: 49-51) *and* (Resasco "Abstract") ("The process also contemplates *processes and apparatus which recycle and reuse the gases* and catalytic particulate materials, thereby maximizing cost efficiency, reducing wastes, reducing the need for additional raw materials, and producing the carbon nanotubes, especially SWNTs, in greater quantities and for lower costs.") (emphasis added). As to Claim 16 and 20, Resasco discloses any number of conversions and yields in the Examples presented. *See e.g.* (Resasco 15: 55-58, 16: 1-11, 18: 67 - 19: 2, 19: 38-61, "Figs 6-10"). Thus, given that Resasco discloses recycle streams, it is necessarily expected that unconverted feed in the amount of 50% or more is

recycled. This (the conversions and the presence of a recycle stream) is the evidence offered to show inherency. "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)). Here, the "product" is the composition of gas in the Resasco recycle stream. As to Claims 27 and 30, note that Resasco discloses the production of "SWNTs" or "single walled nanotubes." *See e.g.* (Resasco 6: 23) ("production of SWNTs"). The claimed diameters for are expected to be taught. Likewise, and in light of the ambiguities associated with the term, it is expected that whatever "axial chiral" means, it is expected to be necessarily taught. Finally, with respect to Claim 32, note that while Resasco is directed in large part to single-walled nanotubes, it discloses "nanotubes" in both the generic (i.e. "nanotubes") and the specific (i.e. "SWNT"). *See e.g.* (Resasco 2: 53-60). Further, Resasco recognizes that which is well known in the art – namely any of the processes for making carbon nanotubes makes all different types: single-walled, multi-walled, etc. This principle is recognized at (Resasco 2: 31-34). Thus, Resasco necessarily discloses multi-walled nanotubes (i.e. there are two "kinds" of nanotubes; single-walled and multi-walled). The claimed diameters are expected to be taught.

[1] Multiple reference 35 U.S.C. 102 rejections are proper when extra references are cited to explain the meaning of a term or show a characteristic not disclosed in the reference is inherent. *See* MPEP 2131.01 et seq.

With respect to Claim 35 and 14-15, to the extent that Claim 35 repeats limitations discussed previously, the preceding analysis is relied upon. It is expected that cooling chamber/gas at, *e.g.* (Resasco 9: 35-36) provides the cooling necessary to condense whatever gas is being claimed. Note that once a fluid is condensed, droplets running down the wall of a reactor can be construed as a "moisture separator." As to Claims 17-19, and 21-23, see discussion of recycle above. As to Claim 26, note the discussion of a porous material at *e.g.* (Resasco 9: 18 *et seq.*) As to Claims 28, 29 and 31 see discussion and references related to diameter, above.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action. The references cited teach each and every limitation of the rejected claims. The pinpoint citations are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found. As to the rejection under 35 U.S.C. §§ 102/103, where the applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the Examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection. See MPEP 2112 III. (discussing 102/103 rejections).

Remarks

The Examiner takes official notice that "IUPAC group 16" containing organic compounds have long been used in nanotube synthesis. In support of taking official notice (*i.e.* in making sure there is substantial evidence on the record), the Examiner provides the following:

1. WO 00/17102 to Smalley, et al – see (Smalley 10: 20) ("oxygen containing hydrocarbons").
2. US 6,919,064 to Resasco, et al – see (Resasco 7: 65 *et seq.*)
3. Maruyama, et al., *Low-temperature synthesis of high purity single-walled carbon nanotubes from alcohol*, Chemical Physics Letters 2002; 360: 229-234.

Using a known material consistent with its known uses is prima facie obvious. Given the high level of skill in the art, one of ordinary skill would recognize an oxygen containing substance as an obvious substitute for other hydrocarbons. To the extent any "motivation" is needed, it is taught by Maruyama at, *e.g.* p. 230, col. 1. Note the "high purity" and lower soot formation. For brevity's sake, the Examiner will refer to this collection of documents as "Smalley, et al." when official notice is taken herein.

Claims 14-23, 26-33, and 35 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon nanotubes* 756-776 (Academic Press 1996).

The preceding discussion accompanying the anticipation rejection *supra* is expressly incorporated herein by reference. See above with respect to 102/103 rejections.

Claims 14-23, 26-33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon*

nanotubes 756-776 (Academic Press 1996), US 6,761,870 to Smalley, et al., Choi, et al., *Controlling the diameter, growth rate, and density of vertically aligned carbon nanotubes synthesized by microwave plasma-enhanced chemical vapor deposition*, Applied Physics Letters 2000; 76(17): 2367-2369 (hereinafter "Choi at __") and Bower, et al., *Nucleation and growth of carbon nanotubes by microwave plasma chemical vapor deposition*, Applied Physics Letters 2000; 77(17): 2767-2769 (hereinafter "Bower at __").

The preceding discussion accompanying the anticipation rejection *supra* is expressly incorporated herein by reference. With respect to Claims 16-23, to the extent Resasco *may* not disclose recycle of the gases in the ratios claimed, Resasco does provide extensive kinetic data and relationships. *See e.g.* (Resasco 14: 55 *et seq.*, 4: 28-30, "Figs 6-10"). Recycling a stream - in addition to the advantages noted in the Abstract – affects the concentrations/partial pressures of components, which in turn affects the rates of reaction. Optimization of this does not impart patentability. *In re Boesch*, 205 USPQ 215, 219 (CCPA 1980). Furthermore, with respect to Claims 28-32, to the extent Resasco *may* not necessarily disclose the claimed diameter of the resulting nanotube, the diameter of the catalyst controls the diameter of the nanotube. To the extent Resasco may not teach this, the Examiner takes official notice that this parameter is old and known. In support of taking official notice (i.e. in making sure there is substantial eveidence on the record), the Examiner cites to US 6,761,870 to Smalley, et al. at 8: 58 *et seq.*: "Generally, the diameter of the growing nanotube is proportional to the size of its active catalyst cluster at the time the tube starts to grow." It should be noted that this parameter is well described in the non-patent literature as well. *See e.g.* (Choi at 2369) ("Thus, the diameter of a carbon nanotube is determined by the grain size of catalyst metals.") *and* (Bower at 2767) ("We found that the

nanotubes grow via a ''base growth'' mechanism in our CVD system, and *there is a strong correlation between the catalyst metal layer thickness and the nanotube diameter.*") (emphasis added). Stated differently, catalyst size is a result-effective variable. With this teaching littering the prior art, optimizing the diameter of the resulting carbon nanotube is well within the ordinary skill in the art. *See In re Boesch*, 205 USPQ 215, 219 (CCPA 1980).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,878,360 to Ohsaki, et al. in view of Smalley et al.

With respect to all claims, Ohsaki appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Ohsaki 7: 35 *et seq.*) Note discussion of catalysts and carbon sources. To the extent Ohsaki doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohsaki and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Ohsaki and Smalley is expressly incorporated herein by reference. To the extent neither Ohsaki nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,102,647 to Yamada, et al. in view of Smalley et al.

With respect to all claims, Yamada appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Yamada col. 3) Note discussion of catalysts and carbon sources. Yamada even mentions alcohol and makes note of its soot suppression, but to the extent Ohsaki somehow doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Note that Applicants in their specification make repeated discussion of a rotary type reactor, which appears to be what Yamada teaches. *See* (Yamada 3: 53 *et seq*) ("rotary bed"). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Yamada and Smalley is expressly incorporated herein by reference. To the extent neither Yamada nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,578,543 to Tennent, et al. in view of Smalley, et al.

With respect to all claims, Ohsaki appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Tennent "Fig. 6," 5: 45 *et seq.*) Note discussion of catalysts and carbon sources. (Tennent 6: 35 *et seq.*). To the extent Tennent doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Note also that Tennent appears to teach the separation and recycle. (Tennent "Fig. 6"). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Tennent and Smalley is expressly incorporated herein by reference. To the extent neither Tennent nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,315,977 to Cantacuzene in view of Smalley, et al.

Cantacuzene teaches a multiple stage method for makming carbon nanotubes. (Cantacuzene 1: 49 *et seq.*). Recycles are taught. (Cantacuzene 4: 65). To the extent

Cantacuzene doesn't teach the alcohol, use of the alcohol is an obvious expedient. (Smalley, et al.). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cantacuzene and Smalley as applied to claim14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Cantacuzene and Smalley is expressly incorporated herein by reference. To the extent neither Cantacuzene nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,905,544 to Setoguchi, et al. in view of Smalley, et al.

Setoguchi teaches a process for making carbon nanotubes that appears to contain all of the separating/collecting parts. *See e.g.* (Setoguchi "Fig. 3"). The catalysts and hydrocarbons are taught. (Setoguchi "col. 6"). To the extent Setoguchi may not teach the alcohols, these are an obvious expeident. *See* Smalley, et al. Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Setoguchi and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Setoguchi and Smalley is expressly incorporated herein by reference. To the extent neither Setoguchi nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCRACKEN whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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